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UNDERWOOD TRACT

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FORT UNION COAL REGION

UNDERWOOD TRACT ANALYSIS

SITE SPECIFIC ANALYSIS

MCLEAN COUNTY, NORTH DAKOTA

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September 1981

Michael J. Penfold
State Director

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INTRODUCTION

The purpose of this action is to consider for leasing the remaining 10.2 million tons of strippable unleased federal coal that would otherwise be bypassed by the existing Falkirk mine.

This site-specific environmental analysis (SSA) has been prepared for the Underwood tract (Map 1) in accordance with federal regulations (43 CFR 3420). It will be used by the Fort Union Regional Coal Team to further consider competitive leasing of federal coal within the tract for a June 30, 1983 coal lease sale schedule. If selected and scheduled, the Underwood tract will make about 10.2 million tons of recoverable federal coal available for leasing.

The effects of mining all coal (federal and nonfederal) in the tract are not addressed in this document. Only the effects of leasing and developing the unleased federal coal are considered. The reasons for this approach are as follows:

(1) The Falkirk Mining Company is operating in this tract with a long-term contract to supply coal to the Coal Creek Power Generating Plant;

(2) The Falkirk Mining Company already has permits to mine much of the area;

(3) The unleased federal coal in the tract is about 3.5 percent of all coal within the tract, and covers about 1,239 acres.

(4) In 1976, the Miles City District of the BLM wrote a technical examination/environmental assessment (TE/EA) in response to a coal lease application which was later dropped. This TE/EA essentially examined the impacts of mining on the whole Underwood tract;

(5) The Underwood tract was included in the West-Central North Dakota Regional Environmental Impact Study on Energy Development, completed by the State of North Dakota and BLM in 1978.

(6) A TE/EA was written by the Dickinson District in 1979 in response to an application to lease 160 acres of federal coal. The lease was later granted to the Falkirk Mining Company.

The impacts caused by leasing and development of the unleased federal coal are related to the total impacts of mining the tract, already determined in previous work.

BACKGROUND

In September of 1979, the Dickinson District Bureau of Land Management (BLM) Office adopted the Golden Valley Management Framework Plan (MFP) for Golden Valley County, North Dakota. In December, 1979, the Miles City District adopted the Redwater MFP for Dawson, McCone, Richland, and Wibaux counties in Montana. The land use planning process included identification areas of high or moderate potential coal areas, application of unsuitability criteria, identification of resource trade-offs, and consultation with surface owners. As a result of that work, areas were identified that could be further considered for coal development. These areas are available for consideration for new competitive leasing, lease exchanges, and lease modifications.

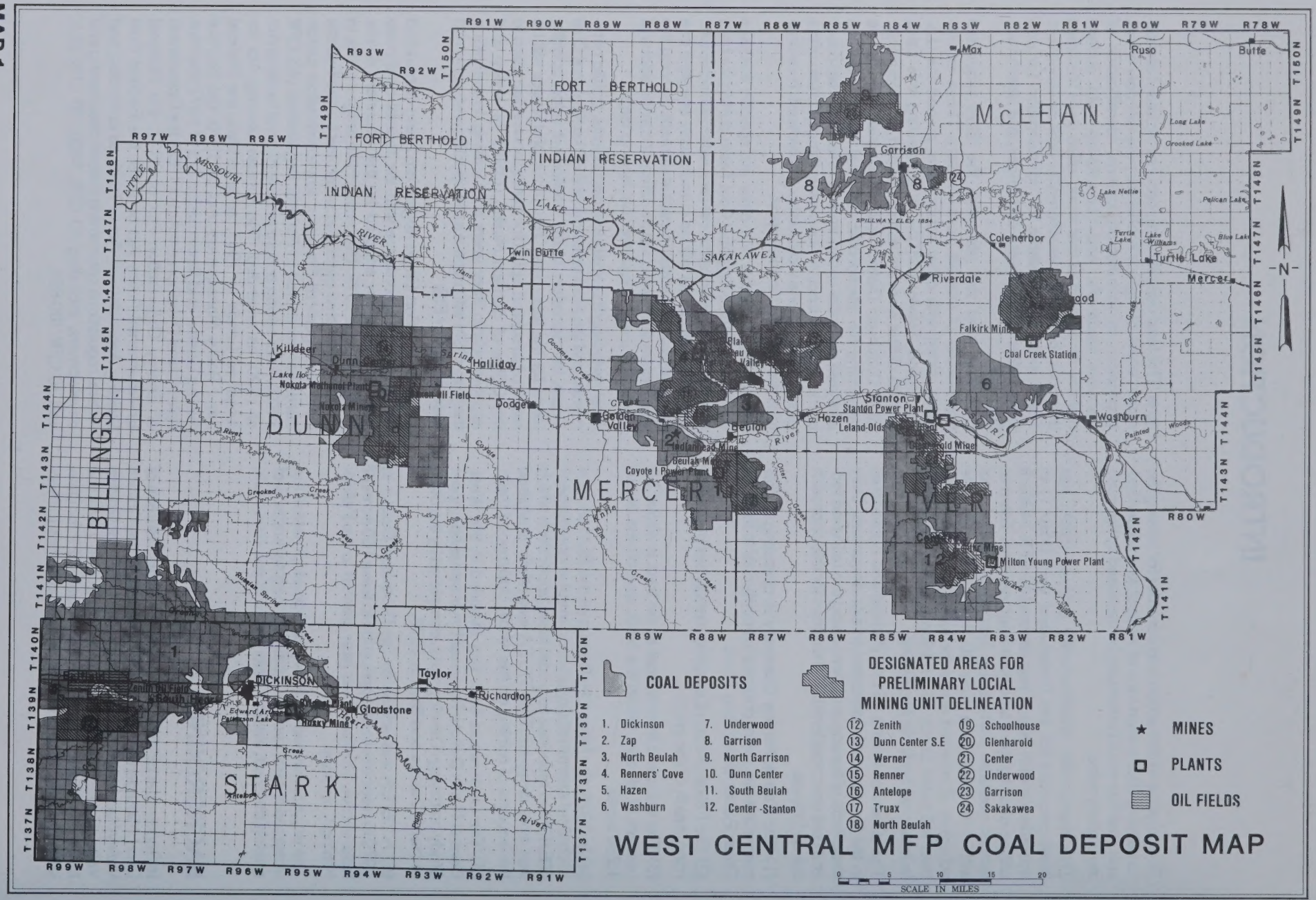
Following land use planning, the BLM requested expressions of interest from industry. These expressions, along with other information, guided the U.S. Geological Survey (USGS) in delineating this tract. Results of that work are summarized in this document. BLM Dickinson District staff inventoried the tract to determine the site-specific resource values and then analyzed potential environmental effects of coal development on this tract. Among other things, certain of the unsuitability criteria were further considered. New findings are reflected in this report.

Information from this and other site-specific analyses will be used by the Regional Coal Team during the tract ranking and selection process for a lease sale schedule. The proposed tracts will be cumulatively analyzed in a regional environmental impact statement. Among the alternatives addressed will be different combinations of tracts that meet a regional coal leasing target.

After reviewing the analytical documents, public comments, and the recommendations of the Regional Coal Team, the Secretary of the Interior will select specific tracts for the lease sale. The successful lessee will be required to submit a plan for mining and reclamation to the Office of Surface Mining (OSM) for review and approval within three years after leasing. In evaluating the plan, OSM will prepare a site-specific environmental assessment or EIS.

Tracts in the Fort Union Region are being considered for leasing in accordance with the federal coal management program adopted by the Secretary of the Interior in June 1979. The basis for the program was, in part, the final environmental statement for the Federal Coal Management Program. Implementation procedures are contained in Federal Regulations (43 CFR 3400). Authorizing actions are the Mineral Leasing Act of 1920, as amended; The Mineral Leasing Act for Acquired Lands of 1947, as amended; the Federal Land Policy Management Act of 1976; the Surface Mining Control and Reclamation Act of 1977; the Multiple Mineral Development Act of 1954; the Department of Energy Organization Act of 1977; the National Environmental Policy Act of 1969; the Federal Coal Leasing Amendments Act of 1976, as amended; and federal regulations concerning federal coal leasing and development, including 43 CFR 3400, 30 CFR 211, and 30 CFR 700-899.

MAP 1



WEST CENTRAL MFP COAL DEPOSIT MAP

TRACT DELINEATION REPORT SUMMARY

The Underwood tract is located in McLean County, North Dakota. It surrounds the town of Underwood (Map 1).

The tract is based on the Underwood bed found in the Sentinel Butte Member of the Fort Union Formation (Paleocene). No geologic hazards are known to exist on this tract.

The Falkirk Mine is located within the tract and there is an existing mining plan on file. However, this mining plan does not include the currently unleased federal and state coal. A possible mining sequence is shown in Map 2. The coal would be mined to a depth of 200 feet or until the limiting stripping ratio of 20:1 has been reached. The most probable end-use of the coal would be nearby Coal Creek Power Plant.

Specific Tract Characteristics:

Acreage:

Surface:	Federal Leased	0
	Federal Unleased	0
	State	280
	Private	24,102
	Total:	24,382
Coal:	Federal Leased	160
	Federal Unleased	1,239
	State	2,072
	Private	20,911
	Total	24,382

Coal Reserves/Millions of Tons:

In Place:	Federal Leased	2.4
	Federal Unleased	11.3
	State	20.8
	Private	287.8
	Total	322.3
Recoverable:	Federal Leased	2.2
	Federal Unleased	10.2
	State	18.7
	Private	259.0
	Total:	290.1

Bypassed Federal Coal: None

Coal Quality: Average of samples as received from vicinity of tract:

Moisture	37.3%
Volatile matter	30.1%
Fixed carbon	27.2%
Ash	5.5%
Sulfur	0.5%
BTU's/lb	6,600

Surface Disturbance/acres

Mining: Annual rate, 431; Total Life of Mine, 22,388

Haul Roads: 330

Mine Facilities: Already built

Stripping Ratio: Less than or equal to 20:1

Coal Thickness: 5 feet to 13 feet

Mine Employment:
Production Phase - 300

Annual Royalties and Severance Taxes:
Federal Royalty, $0.17 million
North Dakota Royalty, $0.27 million
North Dakota Severance Tax, $5.04 million

Water Needs:
Human Consumption, 9,000 gal./day
Source: Well water

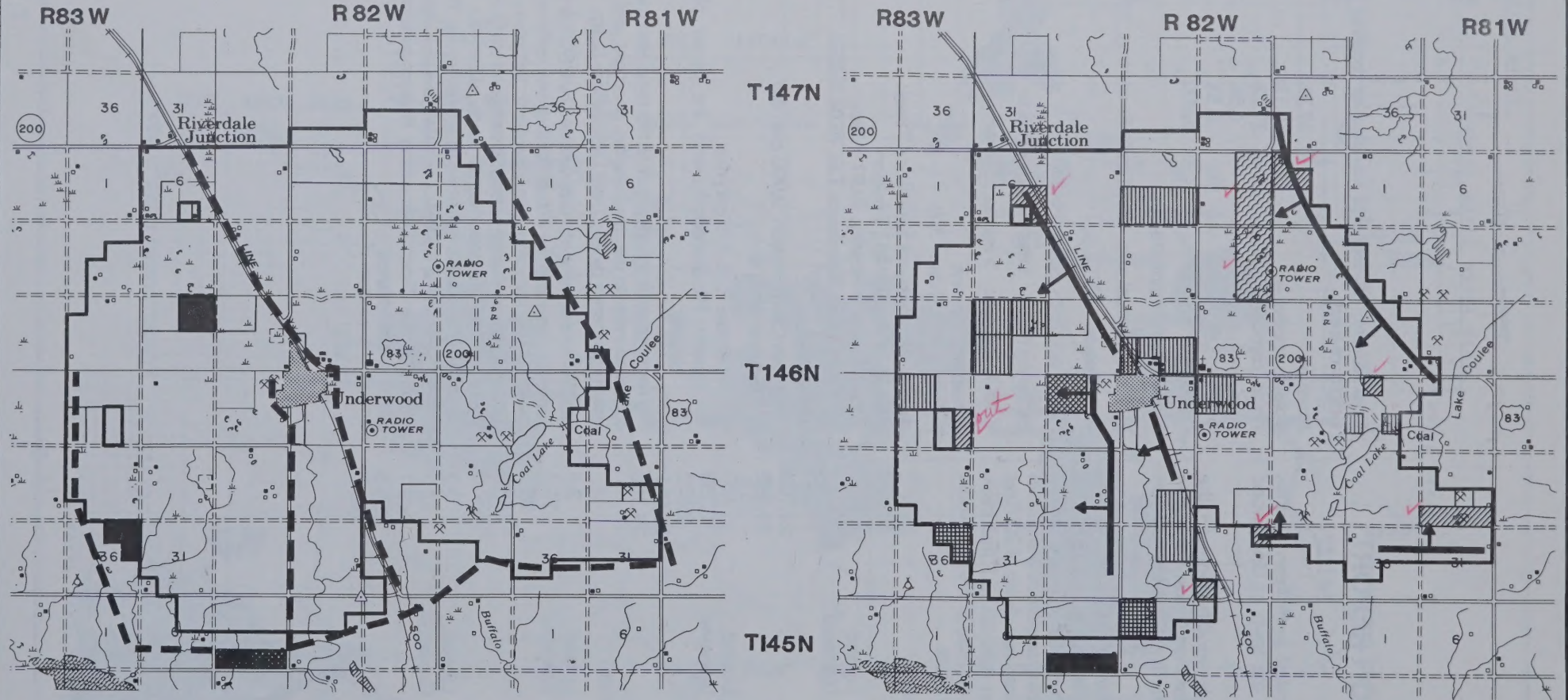
Nonpotable, 120,000 gal./day
Source: Pit dewatering and the power plant's supply

For more specific information on the proposed mining operation refer to the engineering, geologic, and land reports prepared by the Tract Delineation Team.

NOTE: As the mine plans developed by USGS are of a generic nature and the actual mining sequence will be developed by the mining companies to fit their individual needs, the resource specialist assigned to the SSAs made the assumption that all lands within the tract boundaries would be disturbed to some degree. Therefore, acreage in the SSA may not always agree with that shown in the Tract Delineation Report concerning acreage disturbance.

MAP 2

UNDERWOOD TRACT



SURFACE OWNERSHIP

SUBSURFACE OWNERSHIP

LEGEND

- State Surface
- Private Surface
- Tract Boundary
- Federal Coal Lease
- Federal Coal (100%)
- Federal Coal (Less than 100%)
- State Coal
- Private Coal
- Leased State Coal
- Out-of-Pit Haul Roads
- Surface Facilities
- Pit Advancement

-N-

1 0 1 2 3 4 5 6

Scale In Miles

CHAPTER I
ALTERNATIVES

LEASING AND DEVELOPMENT

This alternative is to offer for further consideration the unleased federal coal in the Underwood tract for competitive leasing. This tract has been identified as a logical mining unit for a 5.6 million ton per year surface mine having a 52-year mine life. The Underwood tract has been delineated within areas designated as acceptable for further consideration in the Golden Valley and Redwater Management Framework Plan adopted September 1979 and December 1979. The tract does not include any lands for which the surface owner has filed a valid refusal to consent (to mining) prior to April 28, 1981. The tract has been fully cleared of unsuitability criteria numbers 2, 4, 5, 6, 7, 8, 10, 11, 12, 13, 16, 17, 18, 19, and 20 as defined in 43 CFR 3461. Criteria 1, 7, 9, 14, and 15 require further study. With the exception of criterion 3 all unsuitability criteria studies will be completed and fully applied before work begins on the final regional environmental impact study. If not, this tract will be dropped from further consideration. Criterion 3 will be deferred until mining and reclamation plans are submitted to the Office of Surface Mining and North Dakota Public Service Commission for final approval. Current unsuitability concerns are shown on Map 3. The following is a list of unsuitability criteria.

(1) Federal Land System
(2) Rights-of-Way and Easements
(3) Buffer Zones along R/W and Adjacent to Communities and Buildings
(4) Wilderness Study Areas
(5) Scenic Areas
(6) Lands Used for Scientific Studies
(7) Historic Lands and Sites
(8) Natural Areas
(9) Federally Listed Endangered Species
(10) State Listed Endangered Species
(11) Bald and Golden Eagle Nests
(12) Bald and Golden Eagle Roost and Concentration Areas
(13) Falcon Cliff Nesting Sites
(14) Migratory Birds
(15) State Resident Fish and Wildlife
(16) Floodplains
(17) Municipal Watersheds
(18) National Resource Waters
(19) Alluvial Valley Floors
(20) State Proposed Criteria

Relationship to Other Developments

The Underwood tract includes the Falkirk Mine. The mine opened in 1978 and is producing 5.6 millon tons of coal annually for the Coal Creek Power Plant. The tract is north and east of the center of major coal development in the State of North Dakota. Within a 30 mile radius south and west of the tract there are 4 producing mines and one under construction. All the existing and planned mines produce coal for power plants in the same vicinity.

Farming and ranching are also significant activities in and around the tract.

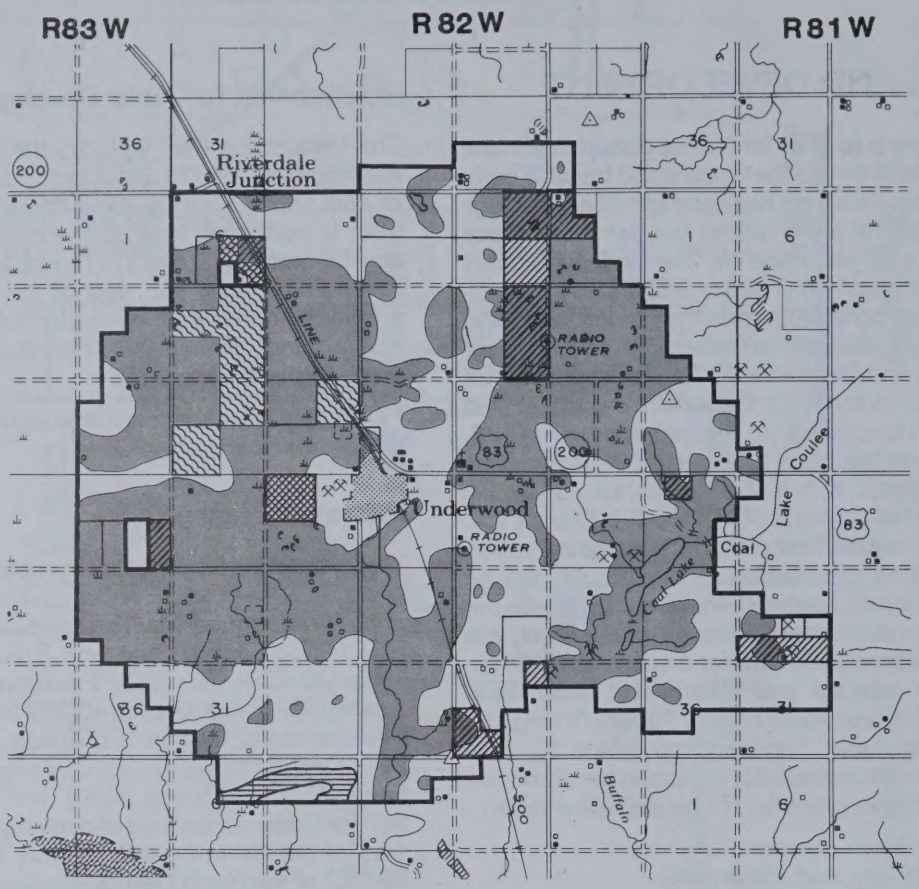
Mitigation Measures

This alternative assumes that proper mining and reclamation will be carried out according to existing state and federal regulations. These include: Office of Surface Mining Reclamation and Enforcement Regulations (30 CFR 700-899), Environmental Protection Agency (EPA) regulations (40 CFR 0-1399), Council of Environmental Quality (CEQ) regulations (40 CFR 211), Department of Interior coal management regulations (43 CFR 23 and 3400), North Dakota Public Service Commission laws and regulations (Chapter 38-14.1 of the North Dakota Century Code and Article 69-05.2 of the North Dakota Administrative Code).

NO LEASING ALTERNATIVE

Federal coal would not be offered for leasing under this alternative. The tract contains 10.2 million tons of recoverable unleased federal coal which represents about 3.5 percent of the total recoverable reserves. It should also be pointed out that the amount of federal coal in the tract is minimal and the individual parcels are scattered. The Falkirk mine or any mine on this tract could operate without the additional federal coal. If the federal coal is not leased, it would be bypassed and would probably never be mined. This alternative would only negatively impact the coal resource and potential state and federal revenues. For other resources, the prevailing trends in the environment would continue.

UNDERWOOD TRACT



LEGEND

- Federal Coal
- Federal Coal Lease
- Active Strip Mine

Areas being considered as unsuitable by BLM and others based on existing information.

- Wetland Easement U.S.F.W.S.
- Potential Dwellings
- Wildlife Habitat

-N-

Note: Detailed maps are available for inspection at the Dickinson BLM District Office. (Rights-of-way too numerous to show.)

1 0 1 2 3 4 5 6

Scale In Miles

MAP 3

CHAPTER II
AFFECTED ENVIRONMENT

TOPOGRAPHY

The Underwood tract is located in the Coteau Slope physiographic area which consists of stream-dissected bedrock with a veneer of glacial deposits. Relief in the area is generally moderate, less than 25 feet locally, but can increase to about 100 feet along deeper valleys such as Coal Lake Coulee. Drainage is well integrated and only a few lakes and sloughs occur.

GEOLOGY AND MINERALS

The tract is underlain by the Sentinel Butte Member of the Paleocene Fort Union Formation. This unit consists of gray interbedded sandstone, siltstone, and claystone with lignite beds. Glacial material dating from the Wisconsin glaciation unconformably overlies the bedrock.

The Underwood bed is the only major lignite resource in the tract. The bed varies from 5 to 13 feet in thickness. South of the town of Underwood there is a parting of up to 1.5 feet. Overburden varies from 0 to 129 feet. The tract as a whole contains 322.2 million tons of reserve base lignite. The federal tracts include 13.7 million tons of lignite (11.32 million unleased and 2.4 million tons leased). No coal would be bypassed.

There are no active oil or gas wells near this tract though apparently there has been some exploratory drilling and seismic surveying in the general area.

PALEONTOLOGY

No fossils of scientific importance are known to occur on this tract.

SOILS AND RECLAMATION POTENTIAL

The soils over unleased federal coal in the Underwood tract have formed in glacial till and alluvium from glacial till. They are primarily deep, well drained, loamy soils of medium to high natural fertility.

As Table 1 indicates, slopes are quite gentle over the area. A few slopes are found along intermittent stream channels. The mostly gentle slopes and loamy textures keep the erosion potential low.

The quality of soil in the area is reflected in the soil suitability for cover of surface mined land ratings and acreage figures for the SCS Order II county soil survey mapping units in the tract (Tables 1 and 2). Of the 4,145 acres involved in this analysis, 3,613 acres or 87 percent is in the "good" suitability category, 477 acres or 12 percent is "fair," and 55 acres or 1 percent is "poor." Some of the soils have horizons too clayey to be rated "good" and two units were rated "poor" because of the presence of mine sinks which pose a serious safety hazard (11 acres) and saline/sodic conditions (44 acres).

The suitability data in Table 2 is developed by surface owners in this analysis report because North Dakota law does not allow the transfer of soil material from one landowner to another unless written consent is given. Each surface owner's land must be reclaimed with soil originally removed from his holdings. The table therefore indicates the degree of difficulty to reclaim individual landowner holdings based on soil suitability for cover of surface-mined land.

TABLE 2
SUITABILITY OF SOIL FOR RECLAMATION BY LANDOWNER IN THE UNDERWOOD TRACT

LANDOWNER NUMBER	----------ACRES---------- GOOD	FAIR	POOR	TOTAL
1	193	7	-	200
2	671	87	30	788
3	17	23	-	40
4	7	-	-	7
5	151	9	-	160
6	5	-	-	5
7	468	12	-	480
8	501	128	11	640
9	417	114	14	545
10	160	-	-	160
11	300	20	-	320
12	120	-	-	120
13	603	77	-	680
TOTALS	3,613	477	55	4,145
% OF TOTAL	87%	12%	1%	100%

1/ Based on Table 1. Planimetry by Bureau of Land Management. Legal description of land and owner name corresponding to landowner number available at Dickinson District Office.

TABLE 1
UNDERWOOD TRACT - SOILS

Map Symbol and Soil Mapping Unit Name[1/]	Percent Slope[1/]	Soil Erosion Potential[1/] Wind	Water	Overall Suitability of Soil for Use as Cover-Soil Material in Surface-Mine Reclamation[2/]	Soil Hazard Conditions[2/]
ArA - Arnegard loam	1-3	Low	Low	Good	-----
BoA - Bowbells loam	1-3	Low	Low	Good	-----
BsB - Bowbells-Williams loams	3-6	Low	Low	Good	-----
BwA - Bowdle loam	1-3	Low	Low	Good	-----
FaA - Falkirk loam	1-3	Low	Low	Good	-----
FbA - Falkirk and Max loams	1-3	Low	Low	Good	-----
FbB - Falkirk and Max loams	3-6	Low	Low	Good	-----
GaA - Grail silty clay loam	1-3	Low	Low	Fair	Too clayey
HaA - Hamerly loam	1-3	Low	Low	Good	-----
Hk - Harriet-Saline land complex	0-1	Mod	Low	Poor	Too clayey, excess sodium and salts
Ma - Makoti silty clay loam	0-1	Low	Low	Fair	Too clayey
MgB - Max loam	3-6	Low	Low	Good	-----
MlC - Max-Zahl loams	6-9	Low-Mod	Mod	Good	-----
MlD - Max-Zahl loams	9-15	Mod	High	Good	-----

TABLE 1
UNDERWOOD TRACT - SOILS

Map Symbol and Soil Mapping Unit Name[1/]	Percent Slope[1/]	Soil Erosion Potential[1/] Wind	Water	Overall Suitability of Soil for Use as Cover-Soil Material in Surface-Mine Reclamation[2/]	Soil Hazard Conditions[2/]
MhC - Max-Bowbells loams	6-9	Low-Mod	Mod	Good	-----
Pa - Parnell silty clay loam	0-1	Low	Low	Fair	Too clayey
Pe - Parnell silty clay loam (very wet)	0-1	Low	Low	Fair	Too clayey
Tp - Tonka-Parnell complex	0-1	Low	Low	Fair	Too clayey
WoA - Williams-Bowbells loams	1-3	Low	Low	Good	-----
WoB - Williams-Bowbells loams	3-6	Low	Low	Good	-----
WoC - Williams-Bowbells loams	6-9	Low-Mod	Mod	Good	-----
WpB - Williams-Bowbells-Zahl loams	3-6	Low	Low	Good	-----
WrB - Williams loam, mine sink	1-6	Low	Low	Poor	Danger of collapse if removal attempted
ZcE - Zahl-Cabba complex	15-35	Mod-High	High	Fair	Some line, Zahl - clayey subsoil
ZmE - Zahl-Max loams	9-35	Mod-High	High	Fair	Too clayey

1/ From "Soil Survey of McLean County, North Dakota".

2/ Derived by applying the properties of the soils over federal coal within the tract which are described in the above mentioned soil survey report and "Official Soil Series Descriptions" to the guidelines developed by BLM-Montana State Office and adapted from information by Wm. Schafer, the Soil Conservation Services (SCS), and the Office of Surface Mining (OSM).

HYDROLOGY

The topography of this area is glacially modified rolling plains and is characterized by numerous sloughs and lakes. Surface runoff from this area is to Weller Slough, Coal Lake Coulee and the Missouri River.

Groundwater aquifers occur at four levels in the shallow geology. The till at the surface has a small amount of water, but where glacial valleys occur the fluvial till will yield quite large amounts of water. A sand unit of the Sentinel Butte formation lies directly above the Hagel lignite. These two units have direct hydrologic connection. The sand is not present over all of the tract. In places there is a silt and clay bed instead. A lower lignite bed (the B bed) also acts as an aquifer. Recharge to the till comes largely from lakes and wetlands and the gradient is generally to the south. All of the other aquifer zones show recharge from an area just south of Underwood. The flow direction of water in these aquifers radiates from this point.

Groundwater quality is generally a bicarbonate sulfate type with the major cations varying from calcium and magnesium at shallow depths to sodium at deeper depths. The city of Underwood and most of the farm wells in the area tap either the sand or Hagel lignite beds. Four of the federal coal tracts have farmsteads located on them.

VEGETATION AND AGRICULTURAL PRODUCTION

Only operations with land over unleased federal coal within the tract were assessed for this tract, since it has been determined that the leasing or not leasing of federal coal would probably have no effect on the viability of development of this tract.

The Underwood tract is extensively used for agricultural purposes. Dryland farming methods, most notably alternate year summer fallow-cropping rotations, are widely practiced in the area. Twenty-nine percent (1,759 acres, McLean County ASCS, 1981) is fallowed each year (Table 3).

Small grains including durum, spring wheat, oats, sunflowers, winter wheat, flax, barley, rye, and corn (in descending order of acreage grown) are grown on 44 percent (2,649 acres) of the tract. Wheat yields average 28.7 bushels per acre. Much of the cropland production, especially the wheat portion, is sold as a cash crop. Oats, barley, and corn are also used as feed grains in livestock operations.

Three percent (193 acres) of the tract is used for growing hay for use in overwinter livestock feeding. Approximately 1.95 tons of hay are produced per acre.

TABLE 3
AGRICULTURAL LAND USE
ON THE UNDERWOOD TRACT

Land Use:	Tract Acres	Average Production Per Acre 1/	Total Annual Production
Cropland	2,649	28.7 bu	76,026 bu.
Hayland	193	1.95 tons	376 tons
Range	1,456	.6 AUM	874 AUM
Other	0	1.95 tons	0 tons
Fallow	1,759	n/a	n/a
Total	6,057	n/a	n/a

1/ Crop : wheat equivalent bu./acre
Hayland: tons/acre
Range : AUMs/acre
Other : tons/acre of hay equivalent

Twenty-four percent (1,456 acres) is rangeland and pastureland. Rangeland produces about .6 Animal Unit Months per acre. An AUM is the amount of forage needed to support a cow/calf for one month. Beef cattle are the predominant kind of livestock (North Dakota Crop and Livestock Reporting Service, 1980). There are also some dairy cattle, hogs, and sheep.

There are approximately 20 acres of shelterbelts, field windbreaks, and farmsteads per operation.

Except for reseeded rangeland, the rangeland is in the widespread Mixed Grass Prairie type (Shaver, J.C. 1977). This includes species such as needle and thread, little bluestem, prairie sandreed, western wheatgrass, blue grama, side-oats grama, plainsmuhly, sedges, snowberry, fringed sagewort, and silver sage.

No threatened or endangered plant species as published on the 1980 federal list have been identified in the tract.

There are 10 operators and operator partnerships, with some land over unleased federal coal in the tract (Table 4). Operations range in size from 120 acres to 1,160 acres inside the tract and from 480 acres to 3,200 acres in total. Tract acres range from fourteen to ninety-two percent of each involved operation within the tract. Overall, the tract covers 39 percent of the acreage of the operations involved.

Agriculture in the area includes crop operations, livestock operations, and mixtures of both. Most operations in the area include a balance between crops and livestock.

Fifty-one percent of the acreage within the tract is farmed by lessees, or operators who do not own the land. Forty-nine percent is farmed by owner/operators.

TABLE 4

FARM/RANCH OPERATIONS - UNDERWOOD TRACT

	INSIDE COAL TRACT (ACRES)							OUTSIDE COAL TRACTS (ACRES)							
OPERATOR	SMALL GRAIN CROP	HAY	GRAZING	SUMMER FALLOW	OTHER	TOTAL	PERCENTAGE OF TOTAL ACRES LEASED	SMALL GRAIN	HAY	GRAZING	SUMMER FALLOW	OTHER	TOTAL	GRAND TOTAL	PERCENTAGE OF TOTAL ACRES IN TRACT
1	344	0	152	224	0	720	100	1306	3	318	853	0	2480	3200	23
2	219	11	350	216	0	796	0	416	30	103	411	0	960	1756	45
3	192	0	81	127	0	400	100	862	33	354	551	0	1800	2200	18
4	206	29	152	53	0	440	64	6	0	33	1	0	40	480	92
5	245	0	89	146	0	480	100	151	0	0	89	0	240	720	67
6	201	40	42	197	0	480	0	161	32	129	158	0	480	960	50
7	61	0	14	45	0	120	0	519	0	57	192	0	768	888	14
8	610	7	169	374	0	1160	14	70	0	5	45	0	120	1280	91
9	301	97	373	172	0	943	79	151	44	133	103	0	431	1374	69
10	270	9	34	205	0	518	61	932	181	501	728	0	2342	2860	18
TOTAL	2649	193	1456	1759	0	6057	51	4574	323	1633	3131	0	9982	15,718	39

AGRICULTURAL ECONOMICS

This section will be forthcoming under separate cover.

LAND USE

The Underwood tract is primarily agricultural as discussed in other sections of this document. The tract also includes existing mining, the town of Underwood including the community facilities related to the town, a segment of State Highway 83, a segment of State Highway 200, several secondary paved roads and unpaved roads along section lines, a railroad right-of-way roughly parallel to State Highway 83, two 230 KV powerlines, abandoned mines, two radio towers, a cemetery, and many agriculture related facilities such as fences, wells and canals.

Underwood, roughly in the center of the tract, provides residential areas and services for, among others, the labor force for existing mining.

RECREATION

Hunting of a variety of species (waterfowl, upland game birds, and deer) is the only recreational opportunity offered to the public on the tract. This opportunity, while significant to local people, has limited attraction to people outside the immediate vicinity of the proposed mining.

The community of Underwood, North Dakota offers recreational opportunities in the general vicinity of the tract. Ball diamonds, parks, and a swimming pool, along with golf, tennis, and gymnasium facilities offer adequate opportunities at this time. Lake Sakakawea, west of the tract, offers state and federal recreational opportunities.

AESTHETICS

Most of the tract is visible from Highways 200 and 83 and from the town of Underwood. Favorable land forms block some views from the town but for the most part mining nearly anywhere on the tract can be assumed to be seen during some part of the mining operation, for the life of the mine.

The area is cropland which varies in appearance from season to season and year to year depending upon the type of crop, the fallow cycle, and the farm operation. Rangeland maintains a relatively stable appearance. Fields are divided by roads along section lines creating a rectangular pattern but from the normal angle of view these lines appear curved because of the rolling topography.

The influence of mining is apparent in the region and within the tract itself and can be considered part of the character of the landscape. Whereas the existing landscape is not particularly valuable as scenery and is blemished by mining activity, it is not unattractive aesthetically. Successful reclamation and the limited extent of mining at any given time will maintain this appearance as long as mining takes place in the area.

WILDLIFE

The Missouri Coteau, due to its glaciated features, is in the heart of the pothole country of North America, and is some of the best waterfowl habitat in the world. Wetland density is exceptionally high. The tract is bounded on the southeast by Coal Lake drainage and on the southwest by Weller Slough drainage. The balance of the area is encompassed by additional expanses of similar glaciated wetland ecosystems.

The Coal Lake drainage supports excellent habitat of woodlands, wood shrublands, and wetlands interspersed with native prairie.

Wetlands provide essential habitat for 22 sensitive wildlife species. The whooping crane is a federal endangered species, and uses this area commonly during annual migrations. Wetlands, woodlands, and interspersed native prairie provide essential habitat for 31 species (Table 5).

The intensively farmed area has resulted in fewer wetlands, but topography dictates continued wetlands, many of substantial size. All remaining native grasslands represent precious relics of the original prairie ecosystem. The rate of native prairie loss in North Dakota has been tremendous, and unplowed prairie is only 20 percent of the original total.

Wetlands comprise 25% of the area; woodlands 10.5%; native prairie 37%; agriculturally disturbed (farmed) 16%; mined areas 5.5%; and roads, communities, and other land uses 6%. (U.S. Fish and Wildlife Service, Western Energy and Land Use Team). Specific areas over federal coal having the greatest wildlife habitat value are portions of Sections 2, 3, 6, and 10, of T146N, R82W, and Section 24 of T146N, R83W.

There are no sensitive fish, amphibians, or reptiles identified in this area at this time.

TABLE 5
WILDLIFE HABITAT AND SPECIES

Woodlands	Wetlands	Native Prairie	Agriculturally Disturbed
*Sharptail Grouse	*Hungarian Partridge	*Sharptail	Sharptail
*Hungarian Partridge	Mourning Dove	Hungarian Partridge	Hungarian Partridge
*Mourning Dove	*Pheasant	Mourning Dove	Mourning Dove
*Pheasant	*Mallard	*Whooping Crane	Pheasant
*Merlin	*Gadwall	*Merlin	Whooping Crane
*Swainson's Hawk	*Whooping Crane	Swainson's Hawk	Swainson's Hawk
Marsh Hawk	*Pintail	Marsh Hawk	Marsh Hawk
Ferruginous Hawk	*Greenwing teal	*Burrowing Owl	Ferruginous Hawk
*Loggerhead Shrike	*Widgeon	*Ferruginous Hawk	Whitetailed Deer
*Whitetailed Deer	*Shoveler	Loggerhead Shrike	Red Fox
*Mule Deer	*Redhead	Whitetailed Deer	Badger
Mink	*Canvasback	*Mule Deer	No. Swift Fox
Beaver	*Ruddy	*Antelope	
Red Fox	*Sandhill Crane	Mink	
Badger	*Swainson's Hawk	Red Fox	
No. Swift Fox	*Marsh Hawk	*Badger	
*Bobcat.	*Sprague's Pipit	*No. Swift Fox	
	*Whitetailed Deer	Bobcat	
	*Muskrat		
	*Mink		
	*Beaver		
	*Red Fox		
	Badger		

*Essential habitat for species

CULTURAL RESOURCES

In the 35 percent of the tract that has been inventoried, no cultural resources have been recorded. Intensive inventory will eventually be conducted across the remainder of the tract. It is not possible to be specific about the kinds of cultural resources that additional inventory will produce.

Cultural resources information has been collected from areas within 20 miles of the tract. Where this collection has taken place, human activity from a prehistoric through historic time range has been recorded. This activity is generally reflected in open plain and breaks sites that are task specific and exploitative in nature (i.e., bison kill sites; lithic scatters of varying size, density, and function; seasonal and major long-term habitation sites).

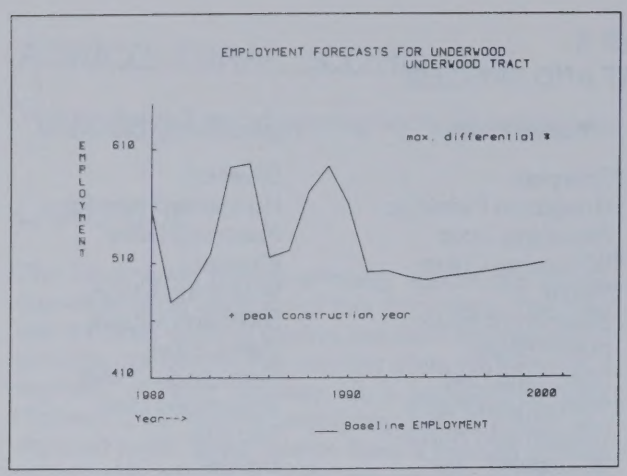
Location on the glaciated Missouri Coteau decreases the tract's likelihood to contain cultural resources. In prehistoric times, an attraction to permanent water would have drawn people to the Missouri Trench. In the vicinity of the tract, periodic exploitative ventures from the Missouri Trench would have been the principal human activity.

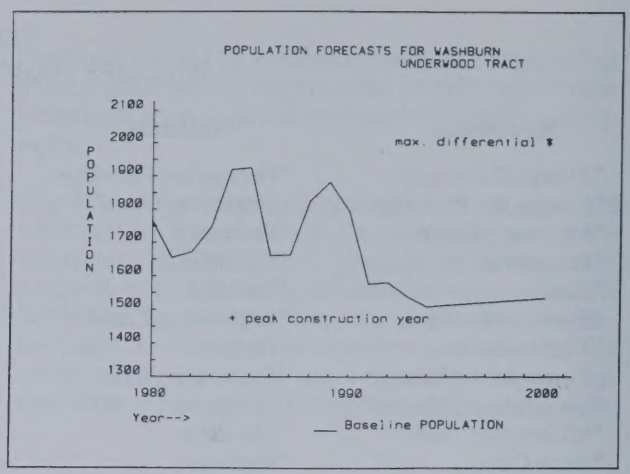
The dominant use of the area in the historic period has been farming. State mining has been a minor use. Most evidence of historic activity is oriented toward farming activity. This activity, which continues to the present time, has possibly eradicated cultural resources from earlier times.

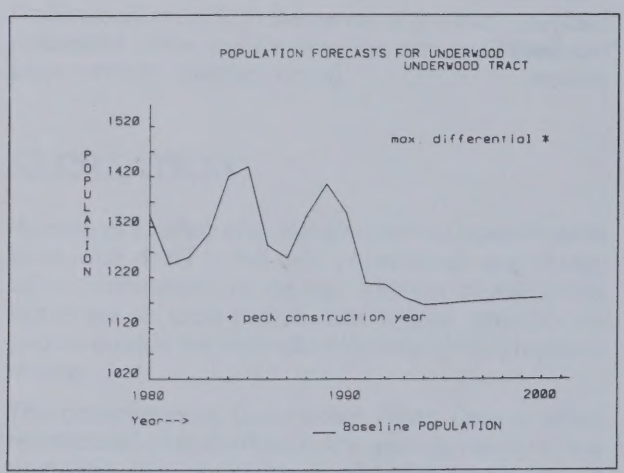
ECONOMIC AND SOCIAL CONDITIONS

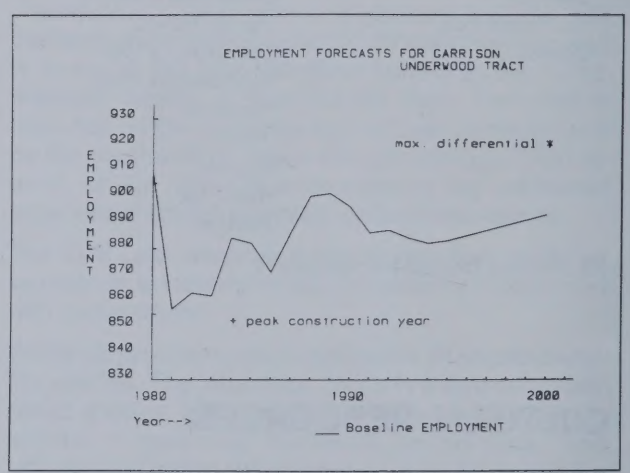
Existing and forecasted population and employment levels for the communities of Underwood, Washburn, Garrison, and Bismarck/Mandan, North Dakota are shown in Figure 1 (Population and employment forecasts: Mountain West 1981). As this figure shows, future population levels in Garrison, without the leasing of federal coal, are expected to remain relatively stable through the early 1990's and then gradually decline. Underwood, Washburn, and Bismarck/Mandan show considerable fluctuations through the early 1990's due to the construction of energy projects not directly related to federal coal leasing.

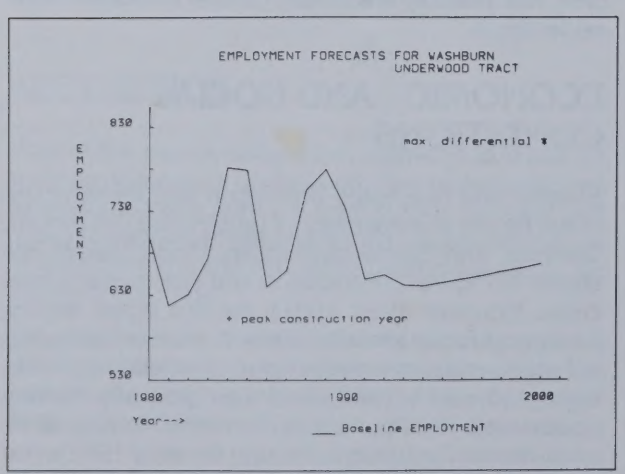
FIGURE 1


EMPLOYMENT FORECASTS FOR UNDERWOOD
UNDERWOOD TRACT
EMPLOYMENT
610
510
410
max. differential *
+ peak construction year
1980
1990
2000
Year-->
___ Baseline EMPLOYMENT


POPULATION FORECASTS FOR WASHBURN
UNDERWOOD TRACT
POPULATION
2100
2000
1900
1800
1700
1600
1500
1400
1300
max. differential *
+ peak construction year
1980
1990
2000
Year-->
___ Baseline POPULATION


POPULATION FORECASTS FOR UNDERWOOD
UNDERWOOD TRACT
POPULATION
1520
1420
1320
1220
1120
1020
max. differential *
+ peak construction year
1980
1990
2000
Year-->
___ Baseline POPULATION


EMPLOYMENT FORECASTS FOR GARRISON
UNDERWOOD TRACT
EMPLOYMENT
930
920
910
900
890
880
870
860
850
840
830
max. differential *
+ peak construction year
1980
1990
2000
Year-->
___ Baseline EMPLOYMENT


EMPLOYMENT FORECASTS FOR WASHBURN
UNDERWOOD TRACT
EMPLOYMENT
830
730
630
530
max. differential *
+ peak construction year
1980
1990
2000
Year-->
___ Baseline EMPLOYMENT

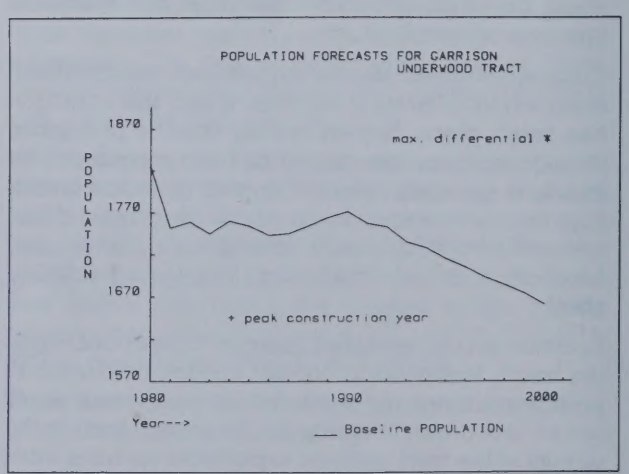
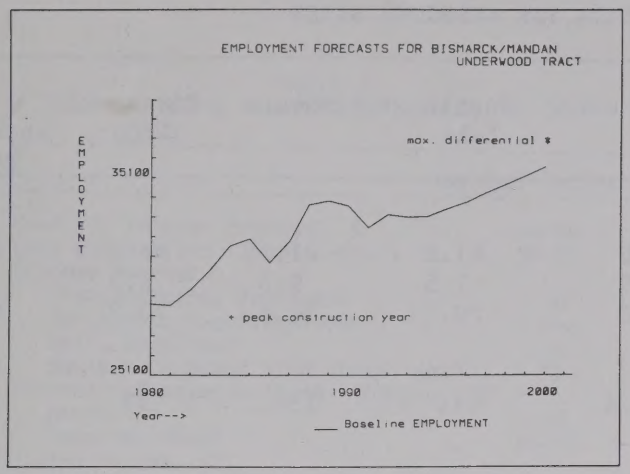
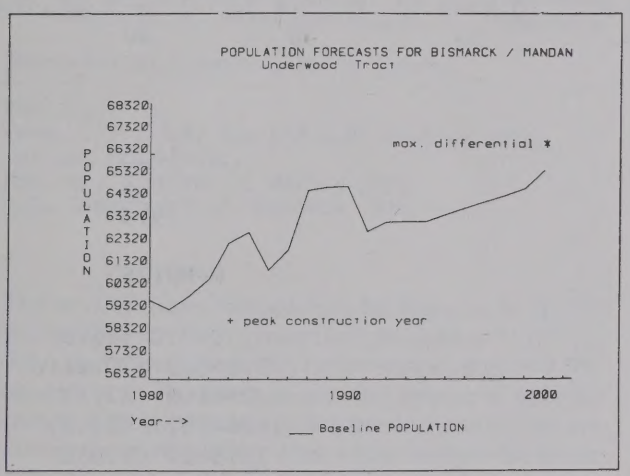

POPULATION FORECASTS FOR GARRISON
UNDERWOOD TRACT
POPULATION
1870
1770
1670
1570
max. differential *
+ peak construction year
1980
1990
2000
Year-->
___ Baseline POPULATION

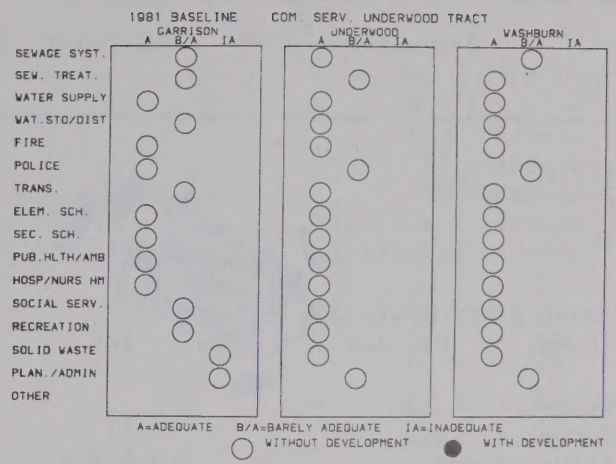
FIGURE 1 (continued)

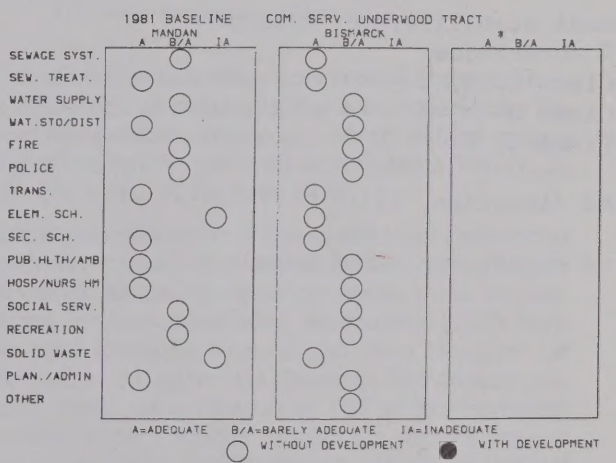




SOURCE: Respective city/county or regional planners.

FIGURE 2





SOURCE: Respective city/county or regional planners.

The vast majority of the employees at the Falkirk mine (with which the Underwood tract is associated) currently reside in Garrison, Underwood, Washburn, Bismarck, and Mandan (Dave Waldrun, 1981.) The present (1981) condition of public services in the four communities is shown in Figure 2.

The adequacy ratings in Figure 2 reflect assessments by city planners and town councils. It should be recognized that some assessments were based on best judgment and are somewhat subjective.

CLIMATE AND AIR QUALITY

The climate of western North Dakota is typically continental, characterized by variable temperature and precipitation. The predominant pressure systems, out of the Gulf of Mexico and the Arctic, account for the rapid alterations of meteorological conditions common to the area. Cold polar air masses dominate the winter months, while moist Gulf air masses prevail in the spring and summer, distributing the major precipitation across the area.

Meteorological data available from surrounding stations are shown in Tables 6 and 7. The meteorological station at Underwood is located within the Underwood tract. The tract is within the National Weather Service (NWS) West Central Region. The meteorological station at Underwood will be used to establish benchmark climatology for the tract.

TABLE 6*
METEOROLOGICAL DATA FOR SELECTED SITES

Parameter	Underwood	Riverdale	Turtle Lake	Washburn	Bismarck (WSO)	NWS West Central Region
Temperature, °F						
$\bar{X}$ annual, °F	40	40	41.2	41.9	41.4	40.6
$\bar{X}$ monthly low (Jan)	9.5	9	7.5	9.3	8.2	8.4
$\bar{X}$ monthly high (July)	71	70	70.1	70.8	70.8	69.4
Average growing season (temp. 32° F), days	128	134	131	133	133	120
Precipitation, in.						
Annual average	17	17	17.22	18.01	15.15	16.91
Annual range	0.4-3.6	0.4-3.4	0.45-3.91	0.35-4.11	0.36-3.40	0.40-3.92
Annual snowfall	24	24	24	30	40	30
Annual stability, (by class)						
% occurrence						
Class A, B, C					14.3	
Class D					56.4	
Class E, F					29.3	
Wind direction, (%)					W-NW(28)	
Wind speed, mph (% of time)					0-3.5 (15.8)	
					3.6-6.9 (20.6)	
					7-11.5 (27.1)	
					11.6-18.4 (23.8)	
					18.5-24 (9.3)	
					>24 (3.3)	
Average wind speed, mph					10.8	

*SOURCES:

Jensen, R. E. 1972.
North Dakota Crop & Livestock Reporting Service 1980.
Ramirez, J. M. and T. Method 1976.
Ramirez, J. M. 1972.
Ramirez, J. M. 1973.
U.S. Department of Commerce 1948-1974; 1973; 1974; 1977; 1979a; 1979b.

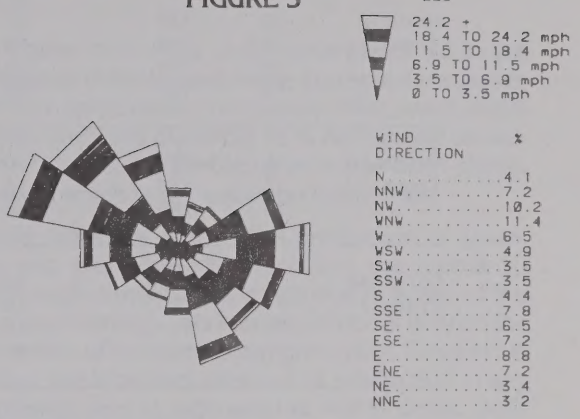
TABLE 7
REPRESENTATIVE REGIONAL METEOROLOGICAL DATA

	Regional Values
Humidity (Annual Average), %	40-50
Lake Evaporation (Annual Avg.), in.	50-55
Extreme Weather	
Thunderstorms, days/year	30
Tornadoes, sightings/year	rare
Hail, days/year	2-4
Maximum recorded wind speed, mph*	72
Inversion Frequency (base 1500 ft.), %	
Annual	35
Seasonal Range	30-50
Mixing Height, ft.	
Mean Annual Morning	984-1312
Mean Annual Afternoon	4921-5249
Mean Seasonal Afternoon Range	1968-7874

*Recorded at Bismarck, North Dakota

Sources:
Brum, L.J., J.W. Enz and J.M. Ramirez 1978.
Jensen, R.E. 1974.
Ramirez, J.M. and T. Method 1976.
U.S. Department of Commerce 1974.

FIGURE 3



WIND ROSE FOR BISMARCK NORTH DAKOTA

The annual mean temperature for the area is 40.0°F with a highest monthly mean temperature of 71.0°F (in July), and a lowest monthly mean temperature of 9.5°F (in January). The average growing season is approximately 128 days; the last spring freeze generally occurs during the third week of May, while the first fall freeze generally occurs during the third week of September (Ramirez, J.M. and T. Method 1976).

Precipitation in the area occurs predominately in the late spring and early summer (May to July). Annual precipitation averages 17 inches at Underwood, and 16.91 inches through the NWS Southwest Region. The average annual snowfall at the Wibaux station is 24 inches.

Wind data used for this analysis were obtained from the Bismarck climatological station, the nearest station to the tract with data suitable for input into the dispersion model. The wind rose in Figure 3 represents a summary of this data. Winds prevail from the W to NW at Dickinson (29 percent frequency of occurrence). Wind speeds average 10.2 mph and exceed 11.5 mph 36 percent of the time.

Although the terrain offers only limited obstruction to the dispersion of pollutants, the area experiences frequent temperature inversions, which reduce mixing heights and tend to concentrate pollutants (Brun L. J., J. W. Enz and J. M. Ramirez 1978).

Table 8 presents some of the available air monitoring data from ambient air monitoring stations in the general vicinity. Recorded annual geometric mean concentrations for total suspended particulates (TSP) from area rural locations have ranged from 15 ug/m^3 (at Garrison) to 31 ug/m^3 (at Stanton). The annual geometric mean concentration of TSP at local privately operated impact source monitoring stations ranged from 21 ug/m^3 (at Falkirk mine) to 44 ug/m^3 (at Coal Creek). For the purpose of the following computer analyses, background rural TSP levels will be set at 24 ug/m^3 for the annual level and 100 ug/m^3 for the 24-hour level.

Three Class I areas, the North and South Units of Theodore Roosevelt National Park and the Lostwoods National Wilderness Area, fall within the potential impact range of the proposed tract and associated developments. Based on 1979 air quality computer modeling estimates by the North Dakota State Department of Health, the allotted 24-hour SO_2 increment for the South Unit of the Park is consumed, or nearly consumed.

TABLE 8
WEST CENTRAL NORTH DAKOTA AIR MONITORING DATA*

Monitoring Site	Year	Parameter	No. Observations	Max. Observation (ug/m^3)	2nd Max. Observation (ug/m^3)	Annual Geom. Mean (ug/m^3)	Annual Arith. Mean (ug/m^3)
			State-Operated Sites:				
Stanton (rural)	76	TSP	61	150	104	31	39
	77	TSP	60	237	90	24	32
	78	TSP	58	104	67	19	24
	79	TSP	42	90	80	19	25
Washburn (rural)	76	TSP	55	127	82	27	35
	77	TSP	55	154	100	25	33
	78	TSP	36	128	108	23	34
Garrison (rural)	76	TSP	58	176	105	28	39
	77	TSP	58	245	132	23	33
	78	TSP	54	69	58	16	20
	79	TSP	36	47	47	15	20
			Privately-Operated Impact Source Monitoring Sites:				
Coal Creek #1	79	TSP	37	242	190	37	56
		SO_2	8106	162	136	<5	<5
	80	TSP	58	413	232	36	57
		SO_2	7681	212	175	<5	<5
Coal Creek #2	79	TSP	37	404	229	44	76
		SO_2	7710	423	394	<5	<5
	80	TSP	61	533	299	40	63
		SO_2	8172	89	89	<5	<5
Coal Creek #3	79	TSP	37	115	105	35	44
		SO_2	6446	185	120	<5	<5
	80	TSP	60	578	222	35	52
		SO_2	7994	358	243	<5	<5
Falkirk #1	79	TSP	43	246	110	24	37
	80	TSP	34	161	126	35	48
Falkirk #2	79	TSP	46	139	99	21	32
	80	TSP	36	94	92	23	32
Falkirk #3	79	TSP	46	196	115	29	42
	80	TSP	37	151	149	38	52
Falkirk #4	79	TSP	43	113	97	24	36
	80	TSP	38	132	85	26	35

*SOURCE - North Dakota State Department of Health

CHAPTER III
ENVIRONMENTAL CONSEQUENCES

TOPOGRAPHY

The natural contour of the land over unleased federal coal would be modified during surface mining. Although most of the surface would be returned to its approximate original contour, difference in detail would remain, including drainage patterns and final sloped highwalls.

In general, the reshaped ground would not be steep enough to cause slope failures and related hazards. Until natural vegetation can be reestablished, accelerated sediment yield and unsightly scars on the land would be potential problems.

GEOLOGY AND MINERALS

The major impact of the leasing alternative would be the addition of 10.2 million tons of federal coal to the reserves available to mining. Mineral resource conflicts may occur between development of oil and gas and mining of coal since there is at least some potential for finding oil and gas on the tract.

SOILS AND RECLAMATION POTENTIAL

The types of impacts affecting the soil resource in this area have previously been discussed in Bureau of Land Management planning documents (Unit Resource Analysis, MFP, TEEA) and the Draft West Central North Dakota Regional Environmental Impact Study. Briefly, the basic impacts, if mining proceeds, are the disruption of the present soil bodies with temporary loss of productivity and problems with erosion, compaction, and instability.

Soil erosion and compaction would not be new to the area because of dryland agricultural activity and coal mining that already exist in the tract. These problems increase during soil handling activities but decrease during other stages of mining. They should not cause significant detrimental effects to the soil resource if the required stipulations are followed.

Some instability problems usually appear with the onset of reclamation. Area-wide settling, localized subsidence or collapse, and underground erosion called piping may occur (Groenwald, 1980). If the stipulations covering the handling of soils and overburden during surface mining operations are closely adhered to and enforced, these impacts should be minimal. The gentle slopes over most of the area would aid in the workability of material and make corrective measures on problem spots easier to carry out. Also, overburden with large amounts of glacial till is not usually as susceptibile to instability problems as is that from clayey, sodic shale which is not common in the tract.

The soils would be lost to the production of grass, forage, and grain over the short-term use (about 10 years for each annual disturbance of 431 acres) of the tract for coal mining. This loss would occur only on the active portion of the mine at any given time. Once in full operation, the total tract area out of production in any peak mining year is estimated at 4,300 acres. Soils would be continuously replaced over mined-out areas and brought back into production during the life of the mine (52 years).

Preliminary indications from completed and ongoing research, by such agencies as the Science and Education Administration—Agricultural Research (SEA-AR) of Mandan, North Dakota and North Dakota State University—Agricultural Experiment Station (NDSU-AES) of Fargo, are that agricultural productivity of mined land can be restored. Much depends, however, on the planning and implementation of a concerted reclamation effort (Power, 1974). The chance for successful return of productivity in this area is high. Table 2 in Chapter II indicates that individual landowners have ample supplies of soil rated good and fair for use as cover soil material in surface-mine reclamation. Agricultural productivity might even increase with reclamation by leaving slopes more gentle where steep slopes now exist, and averaging soil over the landowners' holdings.

HYDROLOGY

During mining the wetlands would be destroyed. This would interrupt the recharge for the local groundwater system. In order to establish a postmining recharge system similar to the premining conditions, a comparable wetland system must be re-created following mining.

The hydrologic impacts on the groundwater, due to mining the surrounding nonfederal coal, would also extend over areas of federal coal if they are not leased. The only additional impact would be to lengthen the period that drawdowns would impact water wells on federal tracts.

VEGETATION AND AGRICULTURAL PRODUCTION

The proposed action would progressively remove an average of 431 acres of the total tract area per year from its current uses. The major use of these lands is agricultural production. The first land taken out of agricultural operations, except for the plant site and ancillary facilities, would occur in the first year of mining. The time period of removal from agricultural production would be the time spent in mining and land reclamation. The entire tract would be progressively mined over a 52-year period.

Mining would be the land use of any one location for one to five years depending on the type of mining. Land reconstruction to premining levels of agricultural production would require a total of approximately ten years. The land would be placed into the premining type of agricultural production or other premining uses that the landowner and Public Service Commission agree upon (wildlife habitat, woodlands, or rights-of-way). Vegetation reestablishment would occur during the first appropriate season after grading to topography and replacing of topsoil.

The company would be under bond for at least ten years, or as long as necessary to prove, at a 90 percent confidence level, that agricultural productive capacity had been restored (Public Service Commission, Reclamation Department, 1980). Reclamation research by such agencies as the Science Education Administration—Agricultural Research Service (SEA-AR) and North Dakota State University—Agricultural Experiment Station (NDSU-AES) indicates that some degree of optimism for the restoration of land to agricultural production is justified, although there is no certainty as to how long it would be before all mined land would be judged as fully restored as the law requires.

The leasing development alternative would have a significant short-term impact on individual agricultural operations in the tract which include land over federal coal. By the end of the 52-year life, 24,782 acres of the tract, including 6,057 acres for operations with land over federal coal, would be disturbed, in addition to 160 surface acres used for mine facilities.

An average of 190 acres of cropland, excluding summer fallow, would be removed from production from the operations with land over federal coal each year, assuming an annual disturbance of 431 acres over a 14-year period. This would be an average annual loss of 5,453 bushels of wheat. This 190 acres of cropland would be out of production ten years with a maximum loss of 53,985 bushels of wheat annually.

Peak mining year disturbance of 137 acres of hayland on operations with land over federal coal would result in an annual loss of 267 tons of hay production.

An average of 103 acres of rangeland, on operations which include land over federal coal, would also be removed from production each year, resulting in an average loss of 62 AUMs. This 103 acres of rangeland would be out of production ten years with a maximum of 1,034 acres out of production in any one peak mining year, resulting in a maximum annual loss of 620 AUMs.

Regionally, these losses would not pose significant reductions in area agricultural production.

Time constraints necessitated the Bureau of Land Management's doing agricultural data collection on the preliminary logical mining unit instead of the later final logical mining unit. The data may not completely represent the logical mining unit in its final form.

In the reestablished native-type range it is likely that some introduced species would be used. The laws require that introduced species be of the same seasonal variety and equal or superior in utility to the native species. Some of the more sensitive plants (for cropland, woodland, or rangeland use) may have difficulty in becoming established on some of the less suitable soils.

Forbs, woody plants, and trees must be reestablished along with grasses.

AGRICULTURAL ECONOMICS

This section will be forthcoming under separate cover.

LAND USE

The inclusion of existing federal bypass areas for coal mining would displace the existing surface uses but would contribute to more organized reclamation of the mined area as a whole. Roads, utility lines and facilities would either be relocated or bypassed making the impact of this advantage difficult to assess. Displacement of existing use during active mining and reclamation would be temporary and represent extending the existing situation through time.

RECREATION

Habitat destruction and the resulting loss of wildlife species (deer, upland game birds, waterfowl) will damage recreational hunting. The impact of this loss has been assessed in the wildlife portions of this document. From the recreation perspective, it is likely the loss will be manageable.

Social and economic studies have documented demographic changes resulting from mining that will stress communities in the vicinity of the tract. This stress will be felt on the available recreation facilities in the communities. Outside of the communities, increased pressure will be seen on private and public land because of recreational opportunities lost to mine related impacts.

AESTHETICS

Mining is part of the fabric of the landscape and its occurrence within this area should surprise no one. The perpetuation of mining over time will have little effect on the existing pattern of use but may make the final reclaimed area more coherent than if areas must be bypassed. Throughout the active mining and reclamation phases of the operation one area or another is likely to be visible and would detract from the existing scenic value of the area.

WILDLIFE

Coal mining and attendant actions would severely disrupt and destroy significant wetlands habitat for sensitive and many other species of wildlife in this area. On-site effects to wildlife resources would be degradation and loss of wetlands, native woodlands, and remnant interspersed native prairie. These are three essential habitats for 31 sensitive species. Agriculturally disturbed areas are of low wildlife habitat value, but do provide spring and fall feeding and loafing habitat for migratory birds.

If mining occurs in these essential habitats and they are not replaced in full (compensation) or are converted to farmland, then there would be significant area losses to wildlife resources.

Additional degradation of similar habitats would be expected adjacent to the mine. Offsite habitats, specifically the aquatic and associated woodlands-native prairie, would be affected.

Mobile wildlife such as birds and large mammals may shift about the habitat losses to some degree, but non-mobile species such as reptiles and amphibians would be destroyed. The very limited availability and disruption of riparian woodlands and wetlands would restrict, and in many cases exclude, the accommodation of disturbed mobile wildlife.

Noise, presence of humans, heavy equipment, dust, and affiliated disturbances cumulatively may cause wildlife to vacate unmined habitats and may preclude adoption by wildlife of those rehabilitated areas until the disturbances are eliminated. This may be for the life of the mine and rehabilitation period, which could be as long as 20 or more years.

Increased human populations resultant of mine development and operations generally reduce wildlife populations and habitat locally and offsite by poaching, road kills, increased legal harvest, disturbance of reproductive and migratory periods and habitats, harassment by recreationists, feral and uncontrolled cats and dogs, and degradation and complete loss of habitat due to housing, shopping centers, water treatment plants and similar urban development. The problem is compounded in areas where shift changes of workers coincide with feeding periods, especially big game. The same would probably occur in this area.

Actions to mitigate these impacts, available to entities other than BLM, would be to provide mass transportation of workers and adjust the times of shift changes which would greatly reduce poaching. This has been used successfully in other mining areas. Providing funds for the North Dakota Game and Fish Department for increased law enforcement or adoption of a poaching clause in union contracts would also help.

Successful reclamation of native woodlands, and wetlands such as "potholes" and riverine wetlands has not been demonstrated. Native prairie has not been successfully reclaimed either, although some prairie plowed about 70 years ago and since left undisturbed has had some native plant species reestablishment.

Concurrent replacement of lost wildlife habitat within 12 to 18 months after mining may reduce a few of the less negative wildlife impacts. However, disruption or loss of any of the larger wetlands and riparian woodlands is expected to become a permanent loss.

At present there is no information to suggest that natural, biologically viable wetlands (e.g., potholes) can be reclaimed from mine spoil in this country. It would be most productive and conservative to eliminate mining from the larger wetlands thereby retaining the critical soils structure of the wetlands and eliminating the extended delay proposed for wetlands reclamation attempts. Destruction of natural viable wetlands by strip mining under the present state of biological and hydrological knowledge would be an irretrievable commitment of wildlife resources.

An interagency team of wildlife biologists from the North Dakota Game and Fish Department, U.S. Fish and Wildlife Service, and Bureau of Land Management have identified and recommended areas for the application of unsuitability criteria (Map 3). Formal recommendations have been received by BLM from the other two agencies. Joint agreement among the agencies and final decisions on unsuitability, exemptions such as producing leases, and exceptions will be completed in August.

CULTURAL RESOURCES

All cultural resources within the tract boundaries are subject to direct and indirect impacts. Direct impacts are those that result from ground disturbance activities

and can result in damage and destruction to sites, artifacts, their environmental context and the data they contain.

Sites not directly impacted by earth disturbance may be impacted as a result of the earth disturbance. These secondary impacts can include vandalism increased by improved access, loss as a result of erosion, or degradation resulting from disruption of natural setting.

In the event of lease, stipulations covering cultural resources will have to be developed. These stipulations will have to treat both recorded and unrecorded sites. They will also have to require management plans for cultural resources that detail mitigation plans for each site to be impacted. As in any cultural resources mitigation, preservation alternatives are preferred. If these options are not viable, then scientific data recovery programs will have to be developed.

ECONOMIC AND SOCIAL CONDITIONS

It is unlikely that the employment level of the mine would significantly change if the Underwood tract is leased. Without a change in mine employment, the population level of the surrounding communities would remain stable. This would result in no additional impacts to community services or changes in social conditions.

The only effect of leasing on community services would be a continuation of the existing level of demand for these services for an additional 40 years (life of the mine). The present condition of public services in communities where existing mine employees reside was shown in Figure 2.

Technical reports are available which discuss the methodology used in the economic or social analysis.

NET ENERGY ANALYSIS

A net energy analysis was calculated using the guidance contained in BLM Washington Office Information Memo 80-640, July 17, 1980. Approximately 37.7 British thermal units (Btus) would be expended to produce a pound of coal. That pound of coal, in turn, would produce about 6,600 Btus. The ratio of energy produced to that expended is 175 Btus/1Btu.

CLIMATE AND AIR QUALITY

Impacts on climate from the proposed action cannot be addressed specifically. This is due to a lack of technical information and research work on the topic of potential impacts on climate. However, general climatic influences applicable to the proposed development can be discussed.

The modification of surface contours and albedo due to redistribution of soils and removal of vegetation may produce slight localized changes in wind speed and direction, temperature, and humidity. Impacts associated with the increased particulate emissions could also alter local climatic conditions. Reclamation with reestablishment of vegetation and a stable landscape should largely mitigate these impacts over the long-term.

The methodology for determining the air quality impact of particulate emissions consists of: 1) obtaining mine profiles for the tract from the Bureau of Land Management (BLM); 2) obtaining emission factors for individual surface coal mining operations; 3) using the mine profile and emission factors for calculation of total emissions; 4) entering the emission data into a modified climatological dispersion model (CDMQC) for prediction of ambient concentrations; and 5) comparing predicted concentrations to Federal and State Ambient Air Quality Standards and to Prevention of Significant Deterioration (PSD) increments. The air quality impact was analyzed for the proposed tract's peak production period.

Details about the CDMQC model, emission factors, and their application appear in the technical report (separate cover).

The results of the modeling analysis were plotted on an isopleth map. The predicted concentrations were then compared with applicable air quality standards. The 1970 Clean Air Act Amendments establish primary and secondary National Ambient Air Quality Standards (NAAQS). North Dakota established air quality standards in 1969. The present Federal and State ambient air quality standards are shown in Table 9.

All pollutant sources must be evaluated to determine if PSD regulations apply. Preliminary evaluations indicate that the proposed coal mine's product emissions (coal dust) would be less than 250 tons/yr; therefore, the coal mine is not a PSD source. However, the State PSD regulations specify that if the fugitive dust emissions cause the total potential particulate emissions to be in excess of 250 tons/year, then the source consumes PSD increment (i.e., these sources do not have to meet PSD regulations, but the emissions from these sources are counted against PSD increment). Table 10 shows Federal and State PSD standards.

TABLE 9
COMPARISON OF AMBIENT STANDARDS
FEDERAL VS. NORTH DAKOTA

	Federal Ambient Air Quality Standards (UPA)			North Dakota Ambient Air Quality Standards	
Pollutant	Wording of Standard	Secondary Standard	Primary Standard	Primary Standard	Wording of Standard
TOTAL SUSPENDED PARTICULATES	Annual geo. mean conc.	60 ug/m^3	75 ug/m^3	60 ug/m^3	Annual geo. mean conc.
	Max. 24-hr. concentration not to be exceeded more than once per year	150 ug/m^3	260 ug/m^3	250 ug/m^3	Max. 24-hr. conc. not to be exceeded more than once per year
SETTLED PARTICULATES (Dustfall)	(At present there is no federal standard.)			15 tons/ sq. mile	Max. 3-month arithmetic mean in residential areas
				30 tons/ sq. mile	Max. 3-month arithmetic mean in heavy industrial areas
COEFFICIENT OF HAZE	(At present there is no federal standard)			0.4 coh. per 1000 linear ft.	Max. annual geo. mean
SULFUR DIOXIDE	Annual arith. avg. conc.		.03 ppm (80 ug/m^3)	60 ug/m^3 (0.02 ppm)	Max. annual arithmetic mean
	Max. 24-hr. concentration not to be exceeded more than once per year		.14 ppm (365 ug/m^3)	260 ug/m^3 (0.10 ppm)	Max. 24-hr. conc.
	Max. 3-hr. concentration not to be exceeded more than once per year	.50 ppm (1300 ug/m^3)		715 ug/m^3 (0.24 ppm)	Max. 1-hr. concentration
REACTIVE SULFUR (Sulfation)	(At present there is no federal standard)			0.24 mg SO_3/100 cm^2/day	Max. annual arithmetic mean
				0.50 mg SO_3/100 cm^2/day	Max. for a 1-month period
SUSPENDED SULFATE	(At present there is no federal standard)			4 ug/m^3	Max. annual arithmetic
				12 ug/m^3	Max. 24-hr. conc. not to be exceeded over 1 percent of the time
SULFURIC ACID MIST, SULFUR TRIOXIDE OR ANY COMBINATION THEREOF	(At present there is no federal standard)			4 ug/m^3	Max. annual arithmetic mean
				12 ug/m^3	Max. 24-hr. conc. not to be exceeded over 1 percent of the time
				30 ug/m^3	Max. 1-hr. concentration not to be exceeded over 1 percent of the time

TABLE 9 (cont.)
COMPARISON OF AMBIENT STANDARDS
FEDERAL VS. NORTH DAKOTA

	Federal Ambient Air Quality Standards (UPA)			North Dakota Ambient Air Quality Standards	
Pollutant	Wording of Standard	Secondary Standard	Primary Standard	Primary Standard	Wording of Standard
HYDROGEN SULFIDE	(At present there is no federal standard)			45 ug/m^3 (0.032 ppm)	Max. ½-hr. conc. not to be exceeded more than twice in any 5 consecutive days.
				75 ug/m^3 (0.054 ppm)	Max. ½-hr. conc. not to be exceeded over twice a year
CARBON MONOXIDE	Max. 3-hr. concentration not to be exceeded more than once per year	9 ppm (10 ug/m^3)	9 ppm (10 ug/m^3)	10 ug/m^3 (9 ppm)	Max. 3-hr. conc. not to be exceeded more than once per year
	Max. 1-hr. concentration not to be exceeded more than once per year	35 ppm (40 ug/m^3)	35 ppm (40 ug/m^3)	40 ug/m^3 (35 ppm)	Max. 1-hr. conc. not to be exceeded more than once per year
OZONE	Max. 1-hr. concentration not to be exceeded more than once per year	0.12 ppm (235 ug/m^3)	0.12 ppm (235 ug/m^3)	235 ug/m^3 (0.12 ppm)	Max. 1-hr. conc. not to be exceeded more than once per year
HYDROCARBONS (Less Meth.)	Max. 3-hr. concentration (6-9 a.m.) not to be exceeded more than once per year	.24 ppm (160 ug/m^3)	.24 ppm (160 ug/m^3)	160 ug/m^3 (0.24 ppm)	Max. 3-hr. conc. (6-9 a.m.) not to be exceeded more than once per year
NITROGEN DIOXIDE	Annual arithmetic avg. concentration	.05 ppm (100 ug/m^3)	.05 ppm (100 ug/m^3)	100 ug/m^3 (0.05 ppm)	Max. annual arithmetic mean
				200 ug/m^3 (0.10 ppm)	Max. 1-hr. conc. not to be exceeded over 1 percent of the time in any 3-month period
LEAD	Quarterly arithmetic mean		1.5 ug/m^3	1.5 ug/m^3	Quarterly arithmetic mean

Sources:

National Ambient Air Quality Standards. 1978.
North Dakota Air Pollution Regulations. 1978.

TABLE 10
FEDERAL AND STATE PSD STANDARDS

	Federal	State
Major Sources, subject to PSD review	100[1]	100[3]
(excludes fugitive dust emissions) (t/yr)	250[2]	250[4]
Major Sources, not subject to PSD review-counts against PSD increment	100[1]	100[3]
(considers fugitive dust emissions) (t/yr)	250[2]	250[4]
Deterioration Increments for Area Designations		
Particulates		
Class I		
annual geometric mean (ug/m^3)	5	5
24-hour maximum (ug/m^3)	10	10
Class II		
annual geometric mean (ug/m^3)	19	10
24-hour maximum (ug/m^3)	37	30
Class III		
annual geometric mean (ug/m^3)	37	37
24-hour maximum (ug/m^3)	75	75
Sulfur Dioxide		
Class I		
annual arithmetic mean (ug/m^3)	2	2
24-hour maximum (ug/m^3)	5	5
3-hour maximum (ug/m^3)	25	25
Class II		
annual arithmetic mean (ug/m^3)	20	15
24-hour maximum (ug/m^3)	91	91
3-hour maximum (ug/m^3)	512	512
Class III		
annual arithmetic mean (ug/m^3)	40	40
24-hour maximum (ug/m^3)	182	182
3-hour maximum (ug/m^3)	700	700

1. Listed sources; CFR Chapter 51:24
2. All other sources (includes coal mines); CFR Chapter 51:24
3. Listed sources; N.D.A.C. Chapter 33-15-15
4. All other sources (includes coal mines); N.D.A.C. Chapter 33-15-15

*SOURCES

Prevention of Significant Deterioration of Air Quality. 1978. Chapter 33-15-15 NDAC Requirement for Preparation, Adaption and Submittal of Implementation Plan. 1978. Title 40 CFR, Part 51.

During peak production of the mine an estimated 3,189 tons per year would be emitted, with the best available control technology applied. Fugitive dust sources would account for 98 percent of the peak production emissions.

Dispersion modeling was performed to predict particulate concentrations for comparison with State and National Ambient Air Quality Standards. Areas within the active mining area, such as the mine facilities, pit area, and reclamation areas, are not subject to these standards.

The isopleth lines on Figure 4 indicate annual average particulate concentrations that could result during peak production. The highest concentration at a location off the mine site could be 6.2 ug/m^3. This level does not exceed the allowable Class II PSD annual increment for particulates. With the estimated annual background concentration added (24 ug/m^3), the ambient level should not exceed State or Federal Ambient Air Quality Standards.

In addition to the annual particulate standard of 60 ug/m^3, North Dakota has a 24-hour standard of 150 ug/m^3 that cannot be exceeded more than once per year off the mine site. Figure 5 shows the predicted highest particulate concentrations for 24-hour averaging times, resulting from the proposed action. The predicted highest 24-hour values associated with the proposed action during peak production could be as high as 37 ug/m^3. This level would consume the allowable Class II PSD 24-hour increment for particulates. With the estimated 24-hour background concentration added (100 ug/m^3), the ambient level would be 137 ug/m^3. This level complies with the State Ambient Air Quality Standards. There is a possibility that the proposed action could violate State and Federal ambient TSP standards, but this is subject to the mine emissions and the corresponding background levels in the area.

Because the proposed action totally consumes the allowable Class II PSD increments for particulates, any associated PSD source could not contribute significantly (5 ug/m^3-24-hour) to the PSD's Class II annual or 24-hour particulates increment.

Several small sources of gaseous pollutants are associated with surface coal mining operations.

During peak production, the relatively small gaseous emissions associated with the mining operations are not expected to violate air quality standards. Gaseous emissions for mining sources were not modeled because of their expected limited impacts to the air quality.

Underwood Tract

TSP Annual Average Concentration (ug/m^3) Isopleths

Note: Number in parenthesis indicates predicted concentration plus background concentration.

FIGURE 4

Underwood Tract

N

TSP Maximum 24-hour Concentration (ug/m^3) Isopleths

Note: Number in parenthesis indicates predicted concentration plus background concentration.

FIGURE 5

CHAPTER IV
CONSULTATION AND COORDINATION

The following organizations were consulted during the production of this document.

Badlands Human Service Center; Dickinson, North Dakota.

Bismarck Planning Director; Bismarck, North Dakota.

Center Mayor and Town Council; Center, North Dakota.

Cumin Associates; Billings, Montana.

Eastern Montana Social and Community Services Task Force.

Energy Development Board of Mercer County.

Garrison Mayor; Garrison, North Dakota.

Lewis and Clark Regional Council Mandan Planning Director; Mandan, North Dakota.

McLean County Agricultural, Stabilization and Conservation Service Office; Garrison, North Dakota.

Mountain West Research; Billings, Montana.

North American Coal Company; Bismarck, North Dakota.

North Dakota Business and Industrial Development Board.

North Dakota Combined Law Enforcement Council.

North Dakota Community Action Association.

North Dakota Energy Impact Office; Bismarck, North Dakota.

North Dakota Game and Fish Department; Bismarck, North Dakota.

North Dakota Geological Survey; Grand Forks, North Dakota.

North Dakota Health Department; Bismarck, North Dakota.

North Dakota Job Service; Bismarck, North Dakota.

North Dakota Social Service Board; Bismarck, North Dakota.

North Dakota State Fire Marshall; Bismarck, North Dakota.

North Dakota State Historical Society; Bismarck, North Dakota.

North Dakota State Public Service Commission, Reclamation and Siting Division; Bismarck, North Dakota.

North Dakota State Tax Department; Bismarck, North Dakota.

North Dakota State University, Sociology Department.

North Dakota State Water Commission; Bismarck, North Dakota.

Three Affiliated Tribes; New Town, North Dakota.

Underwood Mayor and Town Council; Underwood, North Dakota.

United States Bureau of Reclamation; Billings, Montana.

United States Fish and Wildlife Service; Bismarck, North Dakota.

United States Geological Survey, Conservation Division; Billings, Montana.

United States Geological Survey, Water Resources Division; Bismarck, North Dakota.

University of North Dakota, Office of Rural Health.

Washburn Mayor; Washburn, North Dakota.

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SUMMARY MATRIX
UNDERWOOD TRACT
RESOURCE AND ENVIRONMENTAL CONSIDERATIONS

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Topography	Gently rolling glacial deposit.	Less contrasting topography with slight modification of drainage patterns.	Low	Good	
Geology and Minerals					
Geologic Hazards	None identified.	None	N/A	Good	
Potential for Other Minerals	Low (Oil and Gas) - This tract is in the Williston Basin.	Low - There has been exploration activity in the area.	Mining could interfere with development of the oil and gas.	Good	
Paleontological Resources	Low - none identified to date.	Will improve knowledge of the resources near the mine.	Low	Good	
Soils and Reclamation Potential					
Soil Erosion Potential	Erosion potential low on most of the area being considered over federal coal.	Slight increase during soil handling operations, otherwise little change.	Minimal	Outstanding	
Toxic Elements in Soil	No problems	None	None	There has not been a need for this data.	

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Chemicals Corrosive to Metal or Concrete	Corrosivity of most soil to: Untreated metal - High; Concrete - Low	None	None	Outstanding	
Saline/Sodic Soil Conditions	No problem - Glacial till derived soils usually don't have serious sodic conditions.	None	None	Outstanding	
Character of Subsurface Materials and/or Interburden	Up to 50+ feet of glacial till over shale and sandstone. Ninety drill holes in the tract just southwest of Underwood. Data indicates: textures - medium and medium fine, pH - neutral to slightly alkaline, salts and sodium - low.	Some instability problems (settling, piping) may appear primarily during the first 3 years from the onset of reclamation.	Minimal	Outstanding	Only Federal coal covered by the 90 drill holes is NW20, T146N, R82W which was assessed by BLM TEEA in 1979. Data is relevant for the tract, however.
Reclamation Potential					
Based on the soil suitability for cover of surface-mined land, the chances for successful reclamation appear to be high. The breakdown of soil suitability is as follows: Good - 3,613 acres, 87%; Fair - 477 acres, 12%; and Poor - 55 acres, 1%. The glacial till offers plenty of soil material for reconstructing a productive soil profile.					
Hydrology					
Degradation of Groundwater Quality	Shallow groundwater generally does not meet Public Health Service drinking water quality standards but is acceptable for domestic and stockwater purposes.	Groundwater quality will be degraded in the tract.	Between 4 and 8 wells used for domestic and stock watering are located over Federal coal and will be affected.	Hydrology - Outstanding Well Inventory - Acceptable	These wells will probably experience impacts from mining the private coal even if the Federal coal is not leased.

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Vegetation					
Cropland	There are 2,649 acres of land in the tract that are currently being cropped.	Average annual loss of 190 acres excluding 1759 total acres of summer fallow. Annual production on this 190 acres would be 5453 bu. of wheat. Maximum loss in any one peak mining year would be 1881 acres and 53,985 bu. of wheat.	Moderate to high, depending upon individual operation. Low to moderate for overall tract production.	Good	
Rangeland	Average annual production is 874 AUMs.	Average annual loss of 62 AUMs. Each acre would be out of production from 10 to 15 years. Maximum loss for any one peak mining year would be 1034 acres and 620 AUMs.	Moderate to high, depending upon individual operation. Low to moderate for overall tract.	Good	
Agriculture	There are ten operators in the tract	The same number of operators will be affected, to varying degrees, by a long term but temporary loss of acreage for agricultural production.	Very significant to the operators involved.	Outstanding	
	39% of the involved operators' acreage is in the tract.			Outstanding	
	51% of the acreage in the tract is operated by lessees.	Non-owners will lose the use of their leased acreage with no compensation.	Significant to non-owners.	Outstanding	

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Threatened or Endangered Species	There are no threatened or endangered species (on the Federal List) in the tract.	None	None	Good	
Land Use	Agriculture; some mining; a portion of State Highway 200 and State Highway 83, two 230 KV power lines, two radio towers, a cemetery, minor roads, and local utilities.	Displacement of existing use in short term. Relocation or bypass of roads and utilities.	See Vegetation and Agriculture portion of the document. Minor inconvenience.	Acceptable	
Recreation Values	Less than 5% of tract used for recreation.	Loss of recreational areas and added stress on available recreational opportunities.	Limited recreational opportunities make impacts significant.	Good - Based on current studies.	
Aesthetics	Agriculture with some unreclaimed mines. The area is highly visible from Underwood.	Mining is perceived as part of the landscape because of its prominence in the region. Local views would be less attractive and scenic amenities would be impaired in the short term. No impact in the long term.	Moderate to low significance in short term; not significant in long term.	Acceptable	

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Wildlife					
Sensitive Wildlife and Essential Habitats	Essential habitat for sensitive wildlife ranges from 20-70% of the areas for about 30 species. Whooping crane and northern swift fox are identified with the areas.	Coal mining and attendant actions would severely disrupt and destroy locally significant wetlands and woodlands interspersed with native prairie which singly and in composite constitute the essential habitats for 30 sensitive wildlife species. Offsite aquatic habitats of Douglas Creek, Missouri River, and Garrison reservoir would be recipients of potential point and nonpoint pollution.	There would be a significant area loss to wildlife resources if strip mining occurs in the essential wetland, woodlands and native prairie.	1980 CIR aerial photo interpretation by Fish & Wildlife Service, Western Energy and Land Use Team. Unsuitability Criteria Application Team (FWS, NDGF & BLM Biologists). Wildlife data quality is high.	
General					Increased poaching and disturbance would significantly reduce all wildlife populations in region. If not controlled it would significantly reduce recreation opportunities.
Cultural/ Historical Values	Sample Surveys are complete. Recorded cultural resources will not affect coal mining.	Loss of sites as a result of mining activity.	Anticipated impact is not great because resources can be mitigated through data recovery.	Good	None

ELEMENT	PRESENT SITUATION	ANTICIPATED EFFECT OF LEASING/DEVELOPMENT	SIGNIFICANCE OF ANTICIPATED IMPACT	DATA RELIABILITY	COMMENTS
Net Energy Analysis	The Falkirk Mine produced 3.11 million tons of coal from on/or near this tract in 1980.	A total of 5.6 million tons of coal (0.2 million tons of federal coal) will be produced annually.	Production: 6600 Btu/lbs. of coal Consumption: 37.7 Btu/lb. of coal Ratio of production to consumption 175:1	Acceptable	
Climate and Air Quality	Good	Totally consumes the allowable class II PSD 24-hour increment for particulates.	Significant	Fair	Any associated PSD source could not contribute significantly ($5ug/m^3$ - 24-hour) to the PSD's class II 24-hour particulate increment.
		SOCIAL AND ECONOMIC CONSIDERATIONS			
Employment	Community services generally adequate for current employment site.	Very small if any increase in employment.	Insignificant	Acceptable	
Population	Community services generally adequate for current population.	Very small if any increase in population.	Insignificant	Acceptable	
Regional Income	$4560 estimated regional income per capita.	Very small in any increase in regional income per capita.	Insignificant	Acceptable	
Infrastructure Assessment (Community Services)	Most community services generally adequate; often with one or two inadequate services.	No change in community service adequacy.	Insignificant	Acceptable	

UNDERWOOD TRACT
UNSUITABILITY CRITERIA RESULTS

Criterion	Applicable to Tract	Exception Used (if applicable)	Additional Data Needed	Comments
1. Federal land systems	Yes	No	No	Fish and Wildlife Service wetlands and easements.
2. Rights-of-way and easements	No	---	No	---
3. Buffer zones	Yes	No	No	Exceptions may be applied at mine plan.
4. Wilderness study areas	No	---	No	---
5. Scenic areas	No	---	No	---
6. Land used for scientific studies	No	---	No	---
7. Historic lands and sites	No	---	No	---
8. Natural areas	No	---	No	---
9. Federally listed endangered species	Yes, whooping cranes and northern swift fox known or believed to use this region.	---	Swift fox data limited.	Exclusion of strip mining from wetlands would protect most whooping crane areas.
10. State listed endangered species	No	---	No	None exist.
11. Eagle nests	No	---	---	---

Criterion	Applicable to Tract	Exception Used (if applicable)	Additional Data Needed	Comments
12. Eagle roosts and concentration areas	No	---	No	---
13. Falcon cliff-nesting sites	No	---	No	---
14. Migratory birds	Yes	Yes, interagency team applied exceptions as suitable for mining with stipulations.	No	Seven species in combination with Criterion 15.
15. State resident fish and wildlife	Yes	Yes, interagency team applied exceptions as suitable for mining with stipulations.	No	About 30 species in combination with Criterion 14.
16. Flood plains	No	---	No	---
17. Municipal watersheds	No	---	No	---
18. National resource waters	No	---	No	---
19. Alluvial valley floors	No	---	No	---
20. State proposed criteria	No	---	No	None exist.

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